4. REMEDIAL DESIGN

This section outlines the activities that will be taken to meet the remedial action objectives and RGs that have been set forth in the ROD.

4.1 Plume Evaluation FSP Activities

This project is aimed at determining the actions required to meet the goal of "in 2095 and beyond, ensure that SRPA groundwater does not exceed a cumulative carcinogenic risk of 1×10^{-4}, a total hazard index of 1, or applicable State of Idaho groundwater quality standards" (DOE-ID 1999). The plume evaluation will be carried out as a three-step process providing data to support decisions required for the contingent remedy design. Appendix A, Plume Evaluation Field Sampling Plan, details these activities.

Geophysical and chemical data will first be collected from the HI interbed through the deepening of four previously existing wells and the installation of one new well south of the INTEC. Aquifer water will then be collected and analyzed to determine whether these COC maximum concentration action levels are exceeded within portions of the aquifer.

If contaminant levels exceed the model-generated action levels, those zones exceeding the levels will be pump-tested for a period of 24 hours to determine whether they will sustain a flow rate of 0.5 gpm or higher.

If zones having COC levels above the action level yield a sustained flow rate of greater than 0.5 gpm, modeling will be conducted to determine the volume of the contamination plume exceeding the action level.

4.1.1 Drawings and Specifications

This section outlines the specifications for the collection of data required to address the remedial action DQOs. Drawings of the proposed well locations for interbed and aquifer water sampling are also shown.

4.1.1.1 Specifications. Four new monitoring wells/boreholes will be installed by coring through the HI interbed to the first zone of high permeability in the I basalt below the HI interbed, but not to exceed 30 m (100 ft) below the interbed base (Figure 4-1).

The HI interbed is a sedimentary unit located stratigraphically between the H and I basalt flow groups. The interbed is approximately 168 m (550 ft) below land surface at INTEC and generally slopes to the southeast. The average thickness of the unit within the study area is approximately 6 m (20 ft), but thickness ranges from 0 to 18 m (0 to 60 ft) have been observed in nearby wells.

Samples will be collected from interbed materials for chemical analysis of the COCs and for physical and geotechnical analysis. It is anticipated that three sample groups will be collected at each well location: one set of all chemical and geophysical parameters samples from the top; one from the middle of the HI interbed, and one from the bottom of the HI interbed. If zones that have unique hydrogeologic characteristics are encountered in the HI interbed, additional samples will be taken from the HI interbed, if possible.

The new wells and three existing wells will undergo geophysical and fluid logging in order to determine appropriate straddle packer zones for water sampling. Approximately 10 zones will be selected above, within, and below the HI interbed in each of the aquifer monitoring wells. Water sampling will then be conducted on the selected zones and the samples will be analyzed for identified COCs.

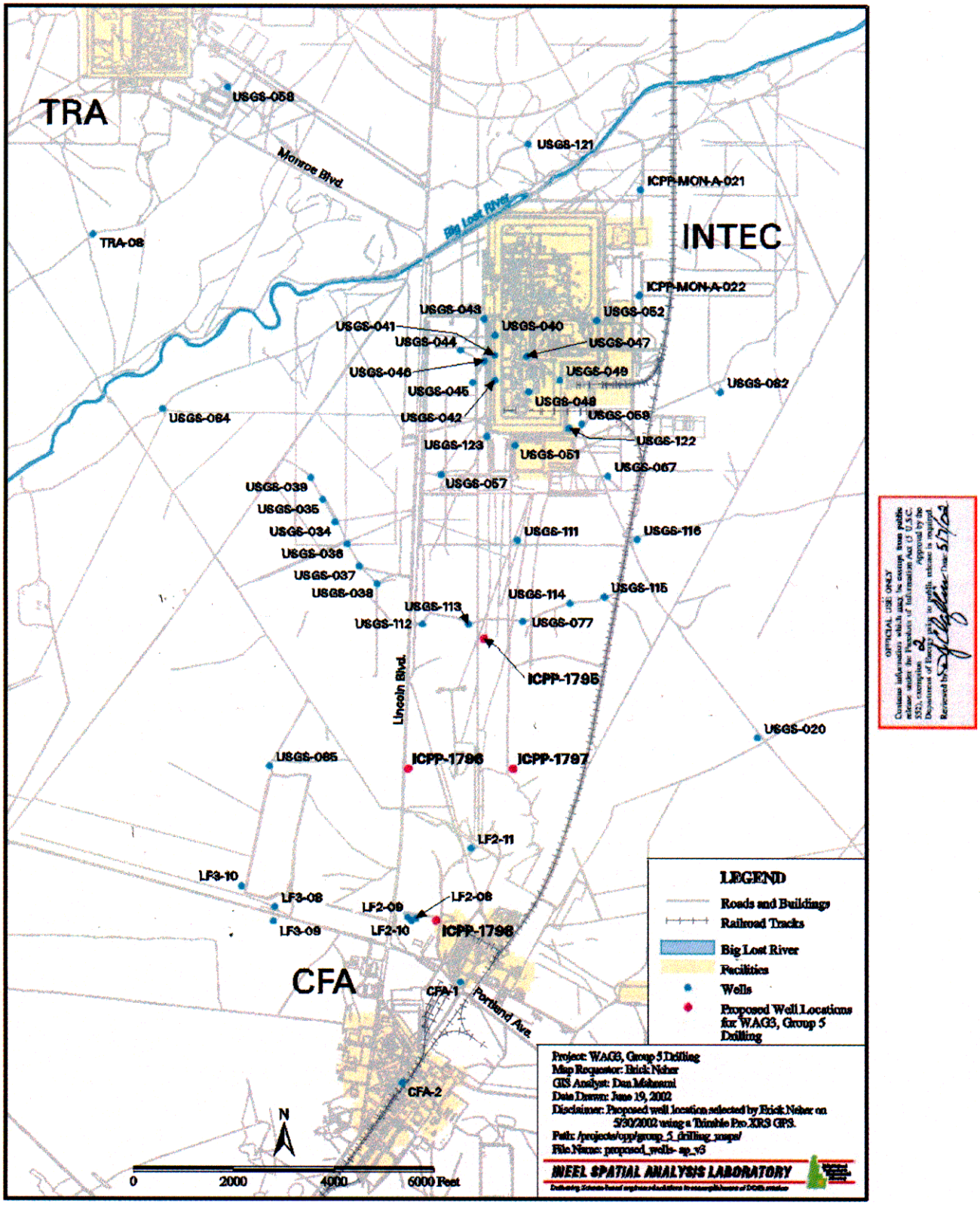

Figure 4-1. Location of monitoring wells to be deepened to sample HI interbed and location of the new well.

At locations USGS-57, USGS-112, and USGS-113, a total of four groundwater samples will be collected and analyzed for Tc-99 and I-129 from the HI interbed zone during the vertical profile sampling. At the new monitoring wells/boreholes, a sample and one replicate sample will be collected from the HI interbed. The I-129 sample, Tc-99 sample, and Tc-99 replicate will be analyzed. The replicate I-129 samples will be analyzed if the Tc-99 replicate samples show significant statistical variability or the I-129 is above the action level.

The statistical evaluation of the Tc-99 replicates will follow data validation guidelines in TPR-80 for duplicate samples. The mean difference will be calculated and, if it is less than or equal to 3, then the results are considered acceptable. The mean difference is calculated from:

$$MD = \frac{|S - D|}{\sqrt{(\sigma_s^2 + \sigma_D^2)}}$$

Where

MD= the mean difference of the duplicate results

S = the original sample result (as pCi/g or pCi/L).

D = the duplicate sample result (as pCi/g or pCi/L).

σ_s = the associated total propagated 1σ uncertainty of the original result (as standard deviation).

σ_D = the associated total propagated 1σ uncertainty of the duplicate result (as a standard deviation).

A MD value of approximately 3 indicates that the results agree at the 3σ confidence interval and an MD value of 1 indicates that the results agree at the 1σ confidence interval. If the MD >3, the relative percent difference (RPD) will be calculated and, if the result is less than 20%, then the samples will be considered to be in agreement. The RPD is defined as:

$$RPD = \frac{\text{high result} - \text{low result}}{\text{average result}} \times 100 .$$

If any zones exceed the model-generated action levels, they will be isolated with a straddle packer assembly and pump-tested for a 24-hour period at a discharge rate of 0.5 gpm. Discharge water samples will be collected during the pump test at 4-hour intervals and analyzed for identified COCs.

Modeling will be conducted to determine the volume of any zones that exceed the COC action level and are capable of producing a sustained yield of 0.5 gpm over a 24-hour period.

4.1.1.2 Drawings and Schematics. This section shows proposed sampling well locations, construction, and the types of samples for data acquisition.

Well Locations—Four new monitoring wells/boreholes will be constructed to sample the HI interbed. Water samples will be collected from these wells/boreholes in addition to three other existing wells. Using other preexisting monitoring wells will assist in determining the lateral extent of the aquifer COC concentrations. These wells are shown in Figure 4-1.

Well Construction/Instrument Diagrams—Existing wells and new wells/boreholes will be used for packer sampling. (Figure 4-2 is a conceptual diagram for straddle-packer sampling.)

Chemical and Geotechnical Data—The type and number of individual samples to be collected from each well are listed in Table 4-1. The actual number collected may vary based on field conditions that are encountered.

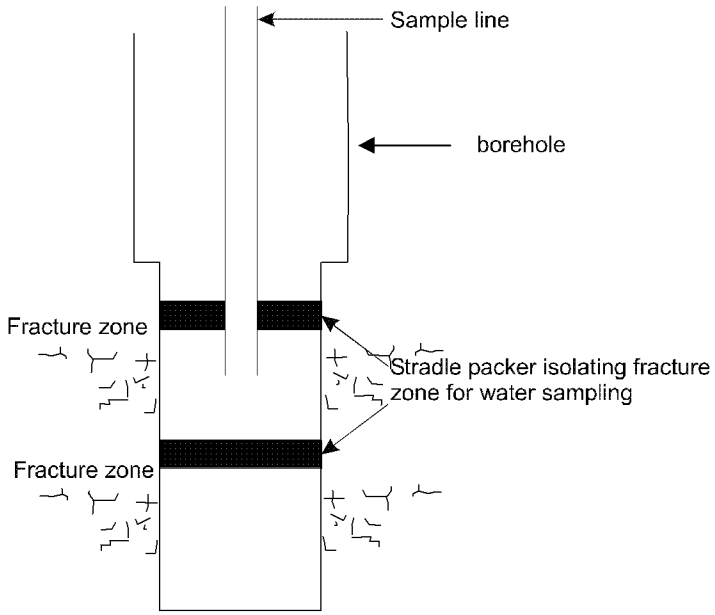

Figure 4-2. Conceptual diagram for straddle-packer sampling.

Table 4-1. Type and number of samples collected.

Analysis	Matrix	USGS 38*	USGS 57*	USGS 67*	ICPP-1795	ICPP-1796	ICPP-1797	ICPP-1798
H-3	Water	10	10	10	10	10	10	10
Sr-90	Water	10	10	10	10	10	10	10
I-129 (standard detection level)	Water	10	10	10	10	10	10	10
I-129 (low detection level)	Water	3	3	3	3	3	3	3
H-3	Interbed	0	0	0	3	3	3	3
Sr-90	Interbed	0	0	0	3	3	3	3
I-129	Interbed	0	0	0	3	3	3	3
Grain size	Interbed	0	0	0	3	3	3	3
Porosity	Interbed	0	0	0	3	3	3	3
Bulk density	Interbed	0	0	0	3	3	3	3
Hydraulic conductivity	Interbed	0	0	0	3	3	3	3

* Anticipated well locations; actual locations may vary due to field conditions

4.2 Long-Term Monitoring Activities

The long-term monitoring activities for WAG 3, OU 3-13, Group 5 will consist of groundwater-level monitoring and groundwater sampling. This will be performed as described in Appendix B, Long-Term Monitoring Plan, to determine if the COC flux entering the SRPA from inside the INTEC security fence and the COC concentrations downgradient of the INTEC facility will cause the groundwater to exceed Idaho water quality standards in the year 2095.

4.2.1 Drawings and Specifications

This section outlines the specifications for the information that will be used to show whether the RAOs have been meet.

4.2.1.1 Specifications. This section covers the methods and materials that will be used in the successful completion of the long-term monitoring activities. Three tasks will be used to determine if the RAO objectives will be met: (1) groundwater sampling, (2) water level monitoring, and (3) comparison of field data with, and updating the predictions of, the aquifer numerical model.

Groundwater samples will be collected from 47 wells in the INTEC area to provide a baseline of the present state of COC concentration in the aquifer. Following the baseline sampling, long-term monitoring will continue using 20 wells. The long-term monitoring wells include 11 wells within or near the INTEC security fence, three wells to monitor below the HI interbed near the injection well and six wells in the plume downgradient of INTEC, depending on the results, for a period that may be as long as the institutional control period. Tables 4-2 and 4-3 list the wells to be used for the baseline and follow-on groundwater monitoring.

Table 4-2. Baseline groundwater sampling wells.

INEEL Name			
ICPP-MON-A-021	USGS-34	USGS-46	USGS-85
ICPP-MON-A-022	USGS-35	USGS-47	USGS-111
LF2-08	USGS-36	USGS-48	USGS-112
LF2-09	USGS-37	USGS-49	USGS-113
LF2-10	USGS-38	USGS-51	USGS-114
LF2-11	USGS-39	USGS-52	USGS-115
LF2-12	USGS-40	USGS-57	USGS-116
LF3-08	USGS-41	USGS-59	USGS-121
LF3-09	USGS-42	USGS-67	USGS-122
LF3-10	USGS-43	USGS-77	USGS-123
LF3-11	USGS-44	USGS-82	MW-18
USGS-20	USGS-45	USGS-84	

Table 4-3. Long-term groundwater monitoring wells.

INEEL Name		
USGS-40	USGS-52	USGS-57
USGS-41 (sampled below HI interbed)	USGS-59 (sampled below HI interbed)	USGS-67
USGS-42	USGS-121	USGS-85
USGS-47	USGS-122	USGS-112
USGS-48	USGS-123	LF3-08
USGS-48 (sampled below HI interbed)	MW-18	
USGS-49	USGS-113	
USGS-51		

Groundwater elevation monitoring will be performed on a monthly basis for 1 year, followed by quarterly measurements during the second year, semiannually for 2 years, and annually thereafter until it is determined that the RAOs have been met. Table 4-4 lists the wells to be used for the groundwater elevation monitoring.

Table 4-4. Wells for water-level monitoring.

INEEL Name				
ICPP-MON-A-021	LF3-11	USGS-42	USGS-57	USGS-112
ICPP-MON-A-022	USGS-20	USGS-43	USGS-59	USGS-113
LF2-08	USGS-34	USGS-44	USGS-65	USGS-114
LF2-09	USGS-35	USGS-45	USGS-67	USGS-115
LF2-10	USGS-36	USGS-46	USGS-76	USGS-116
LF2-11	USGS-37	USGS-47	USGS-77	USGS-121
LF2-12	USGS-38	USGS-48	USGS-82	USGS-122
LF3-08	USGS-39	USGS-49	USGS-84	USGS-123
LF3-09	USGS-40	USGS-51	USGS-85	MW-18
LF3-10	USGS-41	USGS-52	USGS-111	TRA-08

Approximately 20 wells will be sampled by the micropurge method during the semiannual sampling event. The micropurge pumps will be placed at the same depth as the pumps that are currently in the wells. The current pump depths were evaluated by the USGS and the depth selection was based on borehole fluid and geophysical logging. The pumps were placed in zones of high transmissivity. The goals of the micropurge sampling are to get data that is comparable to historical data collected from the wells and to reduce the amount of purge water generated during sampling.

4.2.1.2 Drawings. Maps showing the well locations for the long-term monitoring are included below. Figure 4-3 shows the locations for the baseline groundwater monitoring wells, and locations of the monitoring wells to be used for groundwater elevation monitoring Figures 4-4 and 4-5 show the well locations for the long-term monitoring.

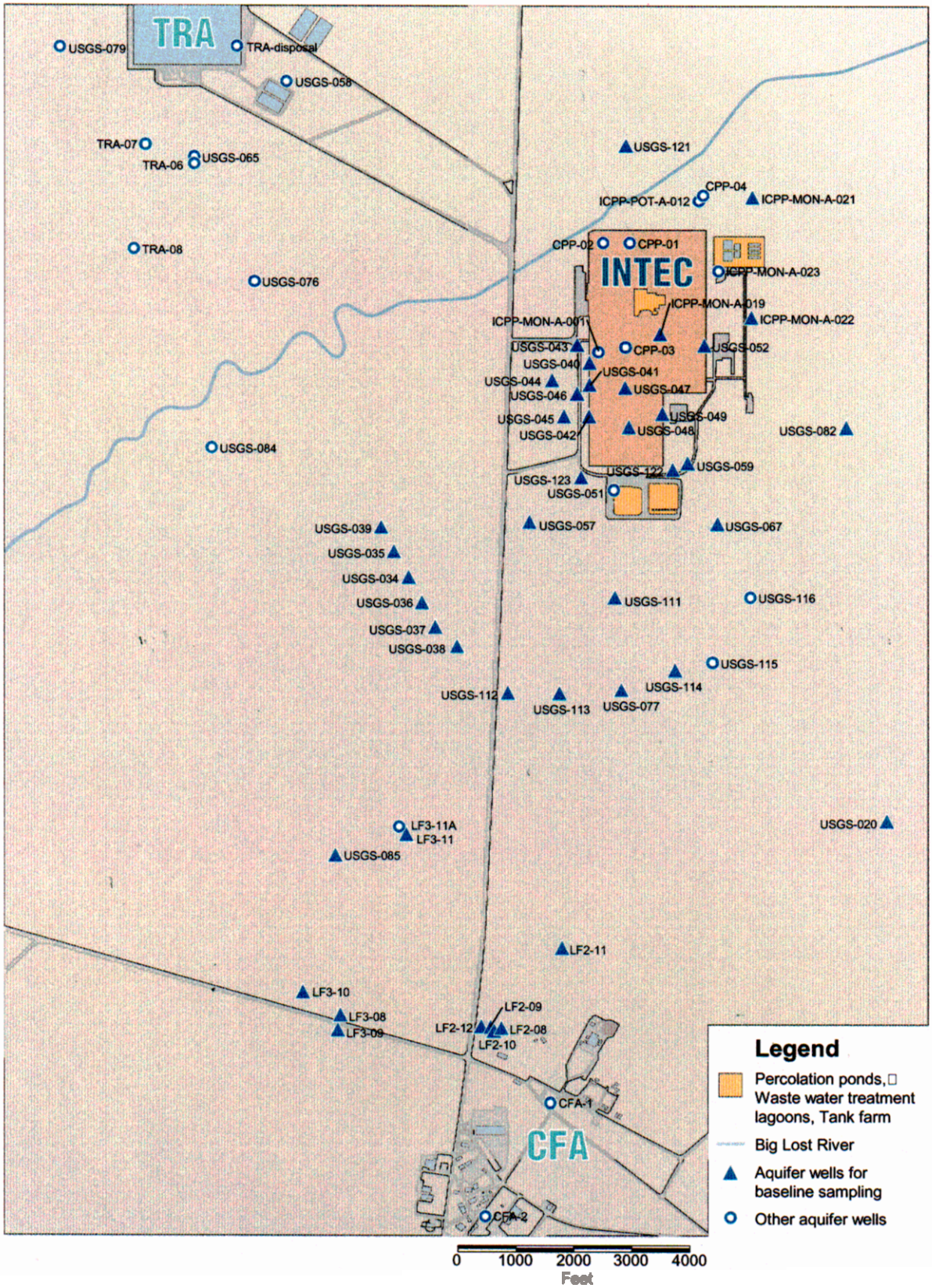

Figure 4-3. INTEC groundwater wells for baseline sampling and water-level measurement.

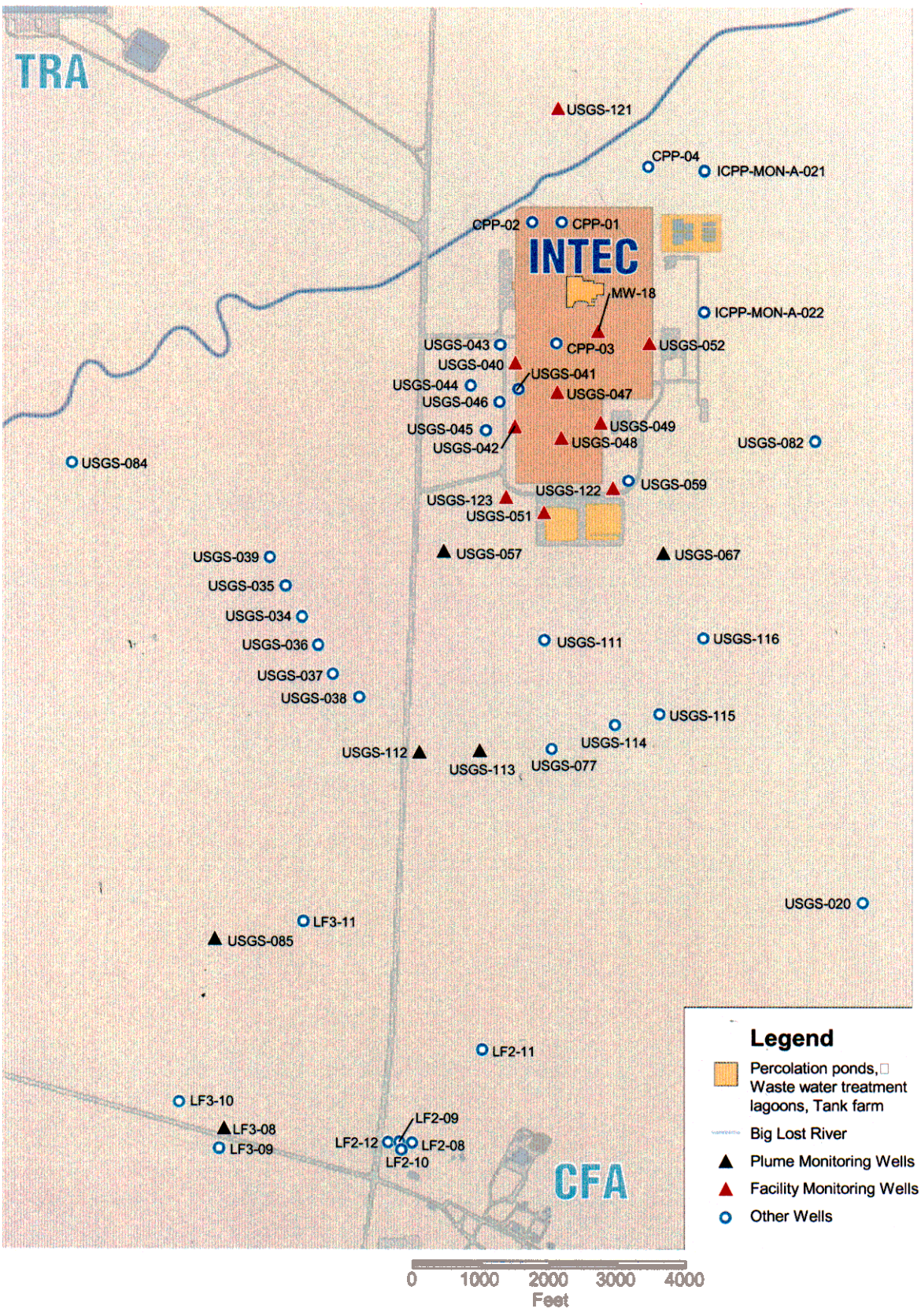

Figure 4-4. INTEC groundwater wells for long-term monitoring.

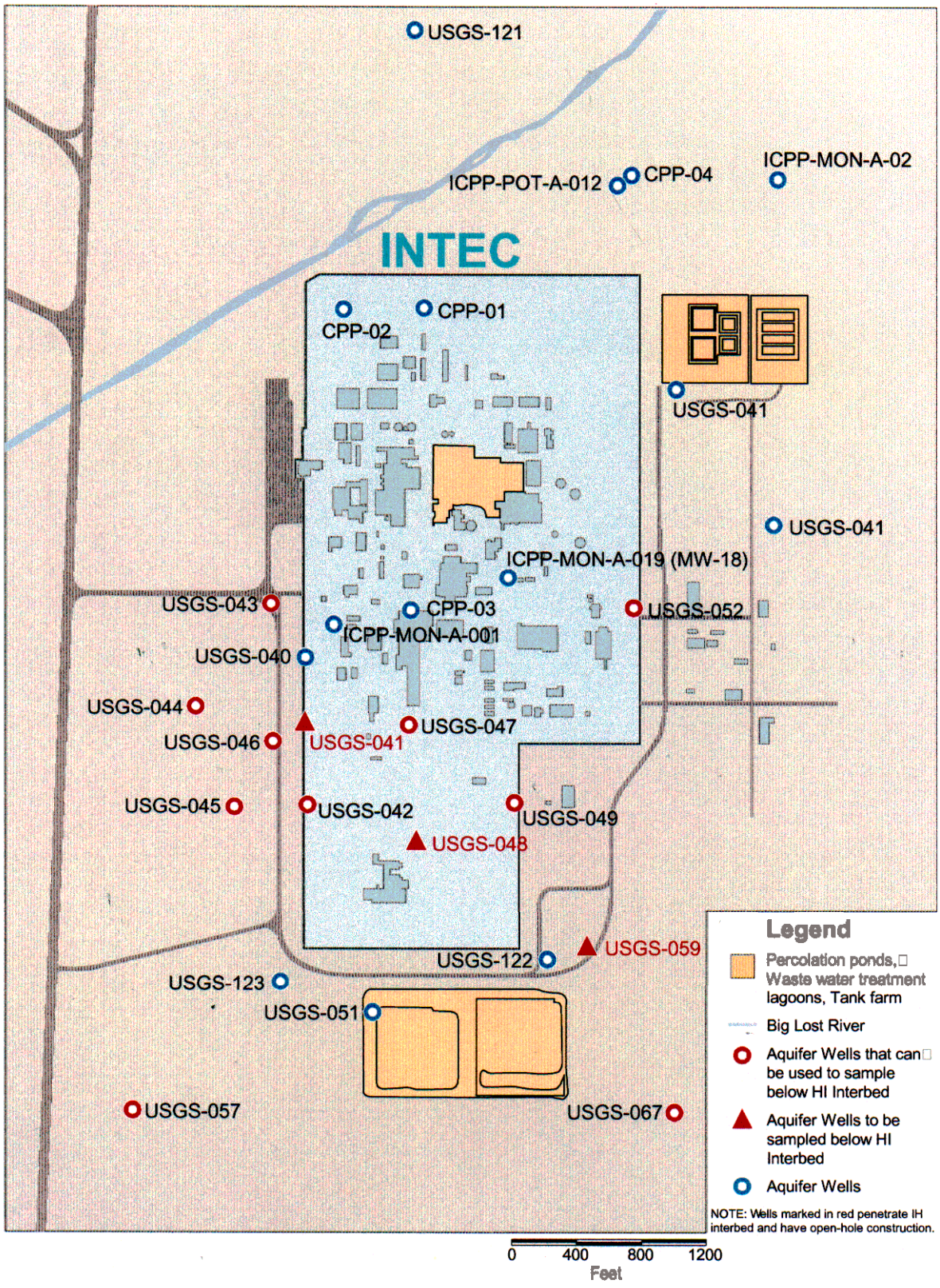

Figure 4-5. INTEC groundwater wells for long-term monitoring of the COC flux from the former injection well below HI interbed.